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PHYSICS.—*Characteristics of radiation pyrometers.*[1] GEORGE K. BURGESS and PAUL D. FOOTE, Bureau of Standards.

Although this investigation, which is largely made up of instrumental details, does not readily lend itself to a brief summary, yet the following conclusions of a general nature may be mentioned.

The Stefan-Boltzmann law $E = (T^4 - T_0^4)$ is not, in general, except by accident, obeyed in its exactness by any of the pyrometers examined. The similar equation $E = a.\ T^4.\ T^{b-4}$, in which b is slightly different from 4 (usually neglecting the T_0 term) is, however, obeyed with sufficient exactness by all total radiation pyrometers.

The main factors influencing the value of the exponent b are the geometry and mechanical construction of the instrument; the value of b for 20 thermoelectric pyrometers ranged from about 3.5 to 4.5. The same instrument of the Féry type may have a different exponent according to its use with or without the sectorated diaphragm for increasing the temperature range. In general, a radiation pyrometer behaves not as a "black" or total receiver of energy, but as a "gray" receiver for the ordinary range of temperatures. For the Féry pyrometer with a gold mirror, for example, the effect of selective reflection of the gold mirror does not become practically appreciable until above 2500°C. but may cause an error of 500°C. at the temperature of

[1] To appear as a Scientific Paper of the Bureau of Standards.

the sun. The auxiliary apparatus, galvanometer or potentiometer, and recording devices, can be constructed so that their errors will be practically negligible. For the work of the highest accuracy the potentiometric method of measurement is to be preferred with thermoelectric radiation pyrometers.

The principal errors to which the several types of radiation pyrometers are subject are shown to lie in the design and mechanical construction of these instruments, and certain of these inherent errors, such as lag or slowness in reaching an equilibrium reading, require for satisfactory results, that the pyrometer be calibrated and used under similar conditions of time of exposure, distance from and aperture of source. Wide variations in the lag effect exist among apparently similar instruments, ranging from a few seconds to an hour or more. These and other errors of appreciable magnitude, such as stray reflection, convection currents, intervening atmosphere, size of source, tarnishing of receiving mirror, etc., should be considered in accurate work. It is shown that errors greater than 100°C. may readily be caused by dirt on, or oxidation of, mirror. The magnitude of errors due to varying the focusing distance, may amount to several hundred degrees if suitable precautions are not taken.

A convenient method for the rapid comparison of different types of pyrometer, and for determining the effects of size of aperture and focusing distance was devised, consisting of a wide nickel (oxide) strip heated electrically, a series of circular, water-cooled diaphragms, and an optical bench.

The methods in use at the Bureau of Standards for the calibration of radiation pyrometers by means of especially designed experimental "black bodies" are described in detail and methods of extrapolation outlined, as well as methods of use of radiation pyrometers, including methods of obtaining approximately correct temperatures for the case in which a source of insufficient size is sighted upon. The application of the radiation pyrometer to the determination of the total emissivity of non-black substances and to the measurement of temperatures is also discussed in detail.

PHYSICS.—*A study of some recent methods for the determination of total sulphur in rubber.*[1] J. B. TUTTLE and A. ISAACS, Bureau of Standards.

This investigation was undertaken to learn whether or not the methods recently published for the determination of sulphur in rubber were any improvement over the Waters and Tuttle method, the one now in use at the Bureau of Standards. The methods investigated were those of Spence and Young; of Deussen, of Alexander, of the Joint Rubber Insulation Committee, of Kaye and Sharp; of Frank and Marckwald, and of Waters and Tuttle. These were subdivided, according to the method of attack, into three classes: direct solution, direct fusion, and solution and fusion methods. A large number of determinations was made on a number of samples, two of the latter being of known composition which were specially prepared by one of the authors.

The methods which have been compared may be divided into two classes, viz. those for the determination of the total sulphur and those for the determination of sulphur other than that present in the insoluble sulphates. It was found that the methods of the second class could not be relied upon to give accurate results.

The direct solution methods, those of Spence and Young, and of Deussen, involve the use of concentrated nitric acid. This was first suggested by Henriques but is objectionable because it gives rise to low results.

The direct fusion methods, those of Alexander, of the Joint Rubber Insulation Committee, and of Kaye and Sharp, are reliable only when the free sulphur content is low, and are therefore not applicable to routine analysis.

The solution and fusion method of Frank and Marckwald was found to be unreliable when the free sulphur was high. The Waters and Tuttle method was found to give satisfactory results and is recommended for general use.

A new suggestion is offered, namely, to determine separately

[1] Detailed paper to appear in the Bulletin of the Bureau of Standards.

the free sulphur and the sulphur remaining after the extraction, reporting the sum of the two quantities as the total sulphur. This procedure eliminates the troublesome effect of the free sulphur upon the determination of the total sulphur.

BOTANY.—*Glaucothea, a new genus of palms from Lower California.* O. F. Cook, Bureau of Plant Industry.

The type of the new genus is **Glaucothea armata** (S. Wats.),[1] commonly known in cultivation as the "blue palm," on account of its extremely glaucous foliage. The peculiar color is due to the presence of an unusually thick coating of wax, and may be considered as an adaptive specialization to desert conditions. Glaucothea is known in a wild state only from the interior of the northern part of Lower California, about sixty miles below the international boundary. It is the nearest neighbor of *Washingtonia filifera*, the only native palm of California, found in the canyons along the eastern base of the San Jacinto Mountains, in the Salton Basin.

The new genus is separated from Erythea, whose type is *Erythea edulis* (Wendl.) S. Wats., a native of Guadelupe Island, off the coast of Lower California. The difference in habitat appears significant when Erythea and Glaucothea are observed in cultivation. Erythea, being a maritime palm, is entirely at home in the cool climate of the Coast Belt of California, flowering and fruiting with great regularity after the proper age has been reached. Glaucothea makes rather slow growth in the Coast Belt, seldom produces flowers, and does not fruit, probably for lack of sufficient heat. Though planted in large numbers in California, the supply of seed is still limited and precarious, being obtained only from the wild palms in the canyons of Lower California. But there is no apparent reason why seed should not be produced eventually by the palms that have been planted in recent years in the drier and warmer interior districts of southern California and Arizona, as at Riverside and Phoenix.

[1] *Brahea* (?) *armata* S. Wats. Proc. Am. Acad. **11**: 146. 1876.
Erythea armata S. Wats. Bot. Calif. **2**: 212. 1880.

Glaucothea appears to be well adapted to these arid regions, and as hardy as *Washingtonia filifera*, which produces fruit in abundance in the Salt River valley of Arizona, as well as in southern California, though not near the coast.

Glaucothea shares with Washingtonia the habit of not producing flowers when young, or until the trunk has attained a height of 15 or 20 feet, while *Erythea edulis* commonly flowers at 5 or 6 feet. Another point of agreement between Washingtonia and Glaucothea is the production of very long slender inflorescences, extending far beyond the leaves. These are in striking contrast with the inflorescences of *Erythea edulis*, which hardly exceed the petioles of the leaves. The massive trunk and heavily armed petioles of Glaucothea afford further analogies with Washingtonia and obvious contrasts to Erythea.

Though more closely allied in its botanical characters to Erythea, the new genus may be distinguished at once, in any stage of development, by the color of the foliage. The floral structures are similar to those of Erythea, but definite specializations are shown. As in many desert plants, the flowers are reduced in size and of thicker texture, and the buds are protected by relatively larger and more fleshy sepals. The petals are attached close to the rim of the staminal cup and are not opened widely at the time of flowering, which no doubt reduces the danger of drying the stigma and thus preventing pollination. These and other differences are summarized in the following diagnosis:

Glaucothea Cook, gen. nov.

Distinguished from Erythea by the very robust trunk, strongly armed petiole, thin, papery ligule, decurved midrib, narrow median segments and glaucous, wax-covered leaf-surfaces; inflorescences slender, elongate, greatly exceeding the leaves, the lower primary branches subtended by spathes, the others without spathes; sepals thick and fleshy; petals broadly triangular, rounded at the apex, attached close to the broadly sinuate rim of the staminal cup.

The type species, as already stated, is *Glaucothea armata* (S. Wats.), from the northern part of Lower California. The generic name was suggested by the relationship with Erythea, though not derived in the same manner. Glaucothea means "Gray Goddess," and may be

considered as allusion to Minerva, whose familiar Greek name was "Athene Gray-eye." The olive tree, with its glaucous foliage, was sacred to Athene, and this palm has a similar claim to distinction among the members of its order. The foliage is of a very peculiar, pearly grayish-green, sometimes with a slight tinge of purple. Well-grown individuals are extremely beautiful, and strikingly different from any other fan-palms that have been introduced into the United States.

Following are more extended descriptions of Glaucothea and Erythea, with the contrasting characters stated in greater detail.

GENERIC DESCRIPTION OF GLAUCOTHEA

Trunk large and very robust, tapering gradually from a thick, somewhat bulbous base.

Leaves very numerous, nearly circular in general form, composed of many numerous deeply divided segments; leaf-sheaths recurved only near the end; petioles armed along the margins with numerous strong, hooked spines; ligule thin, without cushions of tomentum; midrib distinctly developed, decurved somewhat as in Inodes, and with several of the median leaf-segments reduced in size; leaf surfaces rendered glaucous by a thick coating of wax.

Inflorescences slender, erect, greatly exceeding the leaves, the axis enclosed in numerous, slender, naked spathes, 3 to 5 of these borne on the elongated base of the inflorescence, below the branches; primary branches of two classes, the lower 4 or 5 large and subtended by spathes, the others small, numerous and without spathes, together forming a terminal panicle like one of the large primary branches; flowering branchlets simple, very long and slender, with the flowers solitary or in clusters of 2 or 3.

Flowers minute, dull purplish, only slightly opened; sepals thick and fleshy to the end, scarious only on the margins; petals broadly triangular, with a rather blunt apex, strongly thickened within, the stamens accommodated by deep excavations; staminal cup with entire, broadly sinuate margins between the abruptly broadened bases of the filaments, bearing the petals near the rim of the cup; pistils set compactly together. Fruit rather small, with a thin pericarp.

SPECIFIC DESCRIPTION

The following details may be added to Watson's brief description of the species, which gave no information regarding the inflorescence or flowers.

Glaucothea armata (S. Wats.) Cook.

Trunk in robust specimens attaining a circumference of about 11 feet, or a diameter of over 3 feet, the height said to attain 40 feet and upward in the wild state, but most of the cultivated individuals still under 20 feet.

Leaves very numerous, forming a large crown, the basal sheath becoming everted only near the end, but much farther up than in Erythea, the petioles thus appearing shorter; surface of petioles beset with small deep purplish-brown scales, these more numerous in the lower part, but much less abundant than in Erythea; margins of petioles indurated, ivory white, armed with strong, curved white teeth, these extremely variable in form and distribution; ligule thin and papery, not densely tomentose-spongy as in Erythea; rachis evident, distinctly decurved; several of the median segments distinctly narrowed, and also some of the basal segments, but much fewer than in *Erythea edulis*.

Spathes green and glaucous when young, without pubescence or scurf except on narrow lines along the margins; lowest spathe about 2 feet long and 3 inches broad, split on both sides at apex, the others split on only one side.

Flowers dull purplish in color instead of creamy white as in *Erythea edulis*, smaller in size and much less conspicuous at the time of flowering, not opened widely; buds also of different shape, more rounded at apex and relatively wider at base because of the large fleshy sepals; flower-clusters subtended by minute bracts less conspicuous than those of Erythea.

The descriptions of the inflorescences and flowers are based on material taken from a living palm in the collection of Mr. C. B. Hale at Santa Barbara, California, July 7, 1913. The specimens are in the U. S. National Herbarium, under numbers 694866 and 694867.

CONTRASTING CHARACTERS OF ERYTHEA[2]

Trunk rather slender, in comparison with Glaucothea, columnar, scarcely thickened at the base.

Leaves fewer and broader than in Glaucothea; leaf-sheaths recurved well below the end, the recurved portion distinguished by the fibers along the margins, functioning with the petiole and increasing its apparent length; margins of petiole denticulate near the base, often

[2] For the original description of Erythea, see Watson, S., Botany of California, 2: 211. 1880.

smooth above; ligule with large, spongy cushions of tomentum; midrib rudimentary, scarcely decurved, only a few of the median segments narrowed; leaf-surfaces vivid green, not concealed by a covering of wax.

Inflorescences robust, spreading, shorter than the leaves, the main axis enclosed in short, robust, shaggy, scale-covered spathes; primary branches 9 to 11, each subtended by a spathe, and with 1 or 2 additional spathes at the base; flowering branchlets simple, rather long and robust, the flowers in clusters of 3 to 6.

Flowers larger, more conspicuous and more widely opened than in Glaucothea; sepals fleshy at base, the upper half thin and scarious, with a reddish costa; petals triangular, with a rather thin, tapering and sharp-pointed apex, spreading wide apart at the time of flowering; staminal cup with deep sharp incisions between the broadly sloping bases of the filaments, each alternate filament subtended by a strong vertical carina on the inner face of the staminal tube.

Fruits large, the seed surrounded by a thick, firm pericarp, fleshy and edible when mature.

COMPARISON OF INFLORESCENCES

Perhaps the most striking differences between the two genera are those that determine the forms of the inflorescences. With respect to these characters Erythea might be compared with Inodes, while Glaucothea is more like Washingtonia, both with respect to the greater length of the inflorescences as a whole and the more elongate form of the individual spathes. In Erythea the flowers are borne on rather stiff, spreading branches and appear in large billowy masses inside the crown of leaves, while in Glaucothea they are carried out beyond the leaves and suspended on long drooping, tassel-like panicles. The inflorescence of Erythea is relatively unspecialized, with the numerous primary branches each subtended by a spathe, while the inflorescence of Glaucothea is specialized in two ways. Instead of having a short base with only one or two empty spathes below the branches, as in Erythea, there is a long, slender, stalk-like base with 4 or 5 tubular spathes. Following these are 4 or 5 other ensiform or spathulate spathes, subtending a like number of large primary branches. The remaining primary branches, to the number of 15 or more, are left without spathes; but they are much smaller than the others and all together form a large drooping panicle, like one of the larger branches that are provided with spathes. The total number of spathes is about

the same as in Erythea, but the spathes do not stand in the same relation with the branches. At the base of the inflorescence there are several spathes without branches, and at the end of the inflorescence many branches without spathes. The number of primary branches is greater in Glaucothea, not being limited by the number of spathes.

OTHER RELATED PALMS

The relationships of Erythea and Glaucothea lie on the one side with the fan-palms of the Pacific islands and on the other side with those of Mexico and Central America. In its very large fruits and thick exocarp, Erythea represents the extreme of the American series, and the nearest approach to the Pacific island fan-palms. The foliage is somewhat similar, and the very abundant scaly tomentum of the petioles and spathes is another common feature; but the sepals of the American genera are not thick and woody nor completely coalesced to form a deep cup, as in the Pacific island genus.[3]

The genus Brahea may be considered as the nearest Mexican relative of Glaucothea. It shares with Glaucothea the slender exserted inflorescence, with several empty spathes below the branches. But the species of Brahea are smaller and more slender palms, with small narrowly oval fruits, and the albumen grooved on one side like that of the date palm.

[3] It has long been known that the name Pritchardia is incorrectly applied to the Pacific Island palms, but no satisfactory substitute seems to have been proposed. To supply this deficiency the new name **Styloma** is suggested, in allusion to the large indurated styles. The type species is **Styloma pacifica** (*Pritchardia pacifica* Seem. & Wendl.), from the Fiji Islands. Fifteen other species are known, as recognized in Beccari's revision of the genus (Webbia, **4**: 220–240. 1913), nine of these being from the Hawaiian Islands, and six from other parts of Polynesia; all were described originally under Pritchardia. The Hawaiian species of Styloma are as follows: **S. hillebrandi, S. gaudichaudii, S. martii, S. arecina, S. rockiana, S. lanigera, S. eriostachys, S. eriophora and S. minor.** The remaining species are: **S. thurstonii,** from Fiji; **S. vuylstekeana** and **S. pericularum,** from Pomotu; **S. remota,** from Bird Island; **S. maideniana** doubtfully reported from Melanesia; and **S. insignis,** of unknown origin. Beccari also unites with Pritchardia the Cuban genus Colpothrinax, but this should be retained as distinct from Styloma.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this journal and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

METEOROLOGY.—*Types of storms of the United States and their average movements.* EDWARD H. BOWIE, and R. HANSON WEIGHTMAN. Washington, 1914, 37 pages; 114 charts (U. S. Weather Bureau, Monthly Weather Review, Supplement No. I).

The authors have classed the storms (lows) of the United States according to their point of apparent origin. In this classification they have wisely followed the geographic divisions adopted by an earlier investigator of the subject.

The period covered includes the twenty-one years 1892–1912, and the total number of lows considered was 2597. The authors have departed from the traditional way of portraying storm paths. Instead of indicating by a single continuous line the average path of a group of storms they have taken as the geographic unit of movement the successive five-degree squares across the country, from the Pacific to the Atlantic, and have computed for each five-degree square the mean direction and 24-hour travel, based on the total number of lows of the group under consideration that temporarily occupied the square during the entire period. The results have been expressed by a series of arrows, one for each square. Each arrow shows, first, the number of lows that have temporarily occupied the square, and upon which the computations have been based; second, the mean direction and 24-hour travel of the lows, the length of the arrows being proportional to the average number of miles covered by the lows. Notwithstanding the very large number of lows used, not a few squares are represented by less than five lows, but such deficiency is incident to a work of this character, especially in those regions where lows pertaining to a certain group seldom penetrate.

The advantage of this system lies in the fact that it shows at a glance

the scattering which takes place in the distribution of the several groups of lows in latitude. Thus, the North Pacific group, which is essentially a storm moving in high latitudes, has on the average for January, beginning with latitude 55°, along the 95th meridian and proceeding southward by five-degree steps, seven, six, seven, and four lows, respectively. The corresponding numbers for July are three, one, four, and one. The senior author concludes the paper with a number of precepts collected by him during his service as a forecaster.

W. J. H.

METEOROLOGY.—*The thunderstorm and its phenomena.* W. J. HUMPHREYS. Monthly Weather Review, **42:** 348–380. 1914; Journal of the Franklin Institute, **178:** 517–560, 751–776. 1914.

The Simpson theory, that the great amount of electrical separation in a thunderstorm is due to mechanical rupture of raindrops, the best supported and most consistent theory of this phenomenon, is explained in detail. From this theory it follows, as was already evident from other considerations, that thunder and lightning are neither storm-originating nor storm-controlling factors, but themselves the result of those violent winds that obtain beneath and within large cumulo-nimbus clouds.

Hence those conditions essential to the production of cumulus clouds, that is, abundant humidity and that temperature distribution which induces strong vertical convection, are also essential to, and likewise sufficient for, the genesis of the thunderstorm. This in turn explains why, over land areas, these storms are more frequent in the afternoon than at night, more frequent in summer than in winter, and more frequent in equatorial regions than in higher latitudes.

According to the distribution of barometric pressure and surface temperatures, thunderstorms are divided into five distinct classes, and each class illustrated by a group of three meteorological charts. One of each group gives the typical conditions in question. The other two show respectively the 12 hour antecedent and the 12 hour subsequent conditions.

The abrupt and marked changes in temperature, pressure and wind velocity that accompany the onset of a thunderstorm are all discussed in detail, as are also the downrush of cold air and the uprush of warm, the genesis of hail, the formation of "thunder heads," roll scud, and other details of the storm.

The various forms of lightning, streak, rocket, ball, sheet, beaded,

return and dark, are described, in part by the aid of photographs obtained by rotating cameras, and are in a measure explained. The question as to whether the lightning discharge is direct or alternating is discussed and reasons offered for believing it to be usually if not always direct.

In addition to the above such subjects as the spectrum of lightning, duration of discharge, length of streak, chemical effects and danger; cause of thunder, distance heard, rumbling, etc., are all briefly discussed. W. J. H.

BOTANY.—*A text-book of grasses.* A. S. HITCHCOCK. The Macmillan Co. Pp. 1–276. September, 1914.

The work consists of two parts, the first being devoted to economic agrostology, the second to systematic agrostology. Part I includes an elementary account of such subjects as pastures, meadows, lawns, reclaiming sand-dunes, and the grass-crop areas. Part II is devoted to morphology and taxonomy, with a chapter on ecology and another on nomenclature.

The morphology of the vegetative and floral organs is discussed in considerable detail. The classification adopted is essentially that of Hackel in Engler and Prantl's Pflanzenfamilien. Although this arrangement, especially of the tribes, is in some respects unsatisfactory and artificial, it is, according to the author, the best system yet proposed. There is a key to the 13 tribes and, under each tribe, keys to the genera found in the United States. Paragraphs are devoted to those genera that include economic species, and the more important of these are described and illustrated. Special paragraphs are devoted to such subjects as the origin and classification of the wheats, the cultivated varieties of sorghum, and the weedy species of Bromus.

Appended to Part I is a list of government publications referring to forage crops and special uses of grasses; and to Part II a list of books and articles relating to taxonomic agrostology.

A. S. H.

REFERENCES

Under this heading it is proposed to include, by author, title, and citation, references to all scientific papers published in or emanating from Washington. It is requested that authors coöperate with the editors by submitting titles promptly, following the style used below. These references are not intended to replace the more extended abstracts published elsewhere in this JOURNAL.

METEOROLOGY

ABBE, CLEVELAND, JR. *Washington and Paris winters.* Monthly Weather Review, **42**: 626–628. 1914. (An interesting comparison of the winter temperatures of these two cities.—W. J. H.)

ABBOT, C. G. *Extracts from the annual report of the Smithsonian Astrophysical Observatory.* Monthly Weather Review, **42**: 621–623. 1914. (Discusses the recent work at Washington and in California of the Smithsonian Astrophysical Observatory.—W. J. H.)

BATEMAN, H. *Influence of meteorological conditions on the propagation of sound.* Monthly Weather Review, **42**: 258–265. 1914. (A convenient summary of what is known on this subject, with many references.—W. J. H.)

BEALS, E. A. *Frost forecasts and protection in Oregon, Washington and Idaho.* Monthly Weather Review, **42**: 587. 1914.

BESSON, L. *The halos of November 1 and 2, 1913.* Monthly Weather Review, **42**: 431–436. 1914. (Translated by C. F. TALMAN. Describes and explains an unusually complex halo that was seen in many portions of the central and eastern United States. For criticism see Monthly Weather Review, **42**: 619. 1914.—W. J. H.)

BESSON, L. *The different forms of halos and their observation.* Monthly Weather Review, **42**: 436–446. 1914. (Translated by CLEVELAND ABBE, JR., from Bulletin de la Société astronomique de France, mars, avril et mai 1911. A description of many forms of halos that have been reported.—W. J. H.)

BEZOLD, W. VON. *Theoretical meteorology: more particularly the thermodynamics of the atmosphere.* Monthly Weather Review, **42**: 453-455. 1914. (Communicated to the International Meteorological Congress at Chicago, Aug., 1893.)

BLAIR, W. R. *The diurnal system of convection.* Bulletin Mount Weather Observatory, **6**: 221–243, 1914.

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BLAIR, W. R., and GREGG, W. R. *Free air data in southern California, July and August, 1913.* Monthly Weather Review, **42**: 410–426. 1914. (A discussion of the meteorological portion of an investigation undertaken jointly by the Astrophysical Observatory of the Smithsonian Institution and the Mount Weather Observatory of the Weather Bureau. The data consist of

observations taken by free balloons sent up from Avelon, and of captive balloons and mountain observations obtained on and near Mount Whitney. —W. J. H.)

BOWIE, E. H., and WEIGHTMAN, R. H. *Types of storms of the United States and their average movements.* Monthly Weather Review Supplement No. 1, 1914. (Divides American storms into ten types according to region of origin, and gives on full page charts, the distribution and average 24-hour movement of each type for each month.—W. J. H.)

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BROOKS, C. F. *The distribution of snowfall in cyclones of the eastern United States.* Monthly Weather Review, **42**: 318–330, with 11 full page charts. 1914.

CARPENTER, F. A. *Flood studies at Los Angeles.* Monthly Weather Review, **42**: 385–389. 1914.

CARPENTER, F. A. *Utilization of frost warnings in the citrus region near Los Angeles, Cal.* Monthly Weather Review, **42**: 569–571. 1914. (Discusses practical work in connection with the protection of citrus groves from frost.—W. J. H.)

CARPENTER, F. A. and GARTHWAITE, J. W. *Memorandum on air drainage in the vicinity of the Corona district, Cal.* Monthly Weather Review, **42**: 572–573. 1914.

CLINE, J. L. *Frost protection by irrigation in southern Texas.* Monthly Weather Review, **42**: 591–592. 1914.

COBERLY, E. D. *The hourly frequency of precipitation at New Orleans, La.* Monthly Weather Review, **42**: 537–538. 1914.

COBLENTZ, W. W. *The exudation of ice from the stems of plants.* Monthly Weather Review, **42**: 490–499. 1914. (An interesting account with abundant illustrations, of the formation of ice fringes on the stems of plants rich in sap tubes, analogous to the formation of the familiar columns of "ground-ice."—W. J. H.)

EKHOLM, NILS. *Influence of the deviating force of the earth's rotation of the movement of the air.* Monthly Weather Review, **42**: 330–339. 1914. (Communicated to the International Meteorological Congress at Chicago, August, 1893. Discusses a well known phenomenon with simple mathematics.—W. J. H.)

ERSKINE-MURRAY, J. *The function of the atmosphere in [wireless] transmission.* Monthly Weather Review, **42**: 534–537. 1914. (Reprinted by request from Year Book of Wireless Telegraphy and Telephony, 1914. Regards the atmosphere as divisible into a lower nonconducting layer and an upper conducting layer.—W. J. H.)

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HANN, J. *Remarks on the nature of cyclones and anticyclones.* Monthly Weather Review, **42**: 612–615. 1914. (Communicated to the International Meteorological Congress at Chicago, 1893. Discusses objections to the convectional theory of storms.—W. J. H.)

HARRINGTON, M. W. *Systematic exploration of the upper air with estimates of costs.* Monthly Weather Review, **42**: 619–621. 1914. (Read before the International Conference on Aerial Navigation, Chicago, August, 1893. Interesting in the light of subsequent events.—W. J. H.)

HASTINGS, C. S. *On halos.* Monthly Weather Review, **42**: 617–619. 1914. (Extract from his book "Light," supplemented by recent remarks.—W. J. H.)

HENRY, A. J. *Artificial deepening of the Arkansas at Wichita, Kans.* Monthly Weather Review, **42**: 391–393. 1914. (Bed of river has been lowered five or six feet during the past ten years.—W. J. H.)

HERBERTSON, A. J. *The thermal regions of the globe.* Monthly Weather Review, **42**: 286–289. 1914. (Reprinted from the Geographical Journal, London, Nov., 1912.)

HERRMANN, C. F. VON. *Protection against frost in Georgia.* Monthly Weather Review, **42**: 585–586. 1914.

HUMPHREYS, W. J. *The planets and the weather.* Monthly Weather Review, **42**: 346–347. 1914. (Computes the possible temperature changes caused by the planets and the moon, amounting at times to 0.01°F. to 0.02°F.—W. J. H.)

HUMPHREYS, W. J. *The thunderstorm and its phenomena.* Monthly Weather Review, **42**: 348–380. 1914. Journal of the Franklin Institute, **178**: 517–560, 751–776. 1914. (Discusses the origin of thunderstorm electricity, the kinds and nature of lightning, the mechanics of the thunderstorm and conditions favorable to its development.—W. J. H.)

HUMPHREYS, W. J. *Frost protection.* Monthly Weather Review, **42**: 562–569. 1914. (A discussion of the scientific principles that underly artificial protection against frost.—W. J. H.)

KILLAM, S. D. *Graphical integration of functions of a complex variable with applications.* Monthly Weather Review, **42**: 277–283. 1914. (An entirely mathematical paper.—W. J. H.)

KIMBALL, H. H. *Relation between solar radiation intensities and the temperature of the air in the Northern Hemisphere in 1912-1913.* Bulletin Mount Weather Observatory, **6**: 205–220. 1914. (Discusses the decrease in the intensity of direct solar radiation that followed the eruption of Katmai in June, 1912.—W. J. H.)

KIMBALL, H. H. *Solar radiation intensities at Mount Weather, Va., during April, May and June, 1914.* Monthly Weather Review, **42**: 310–311. 1914.

KIMBALL, H. H. *The total radiation received on a horizontal surface from the sun and sky at Mount Weather, Va.* Monthly Weather Review, **42**: 474–487. 1914. (Total radiation is divided into two parts, direct solar and diffuse sky radiation, and values by decades through the year given for all hours of the day.—W. J. H.)

KIMBALL, H. H. *Solar radiation intensities at Mount Weather, Va., during July, August and September, 1914.* Monthly Weather Review, **42**: 520. 1914.

KIRK, J. M. *Halos and precipitation at Wauseon, Ohio.* Monthly Weather Review, **42**: 616. 1914.

LYMAN, T. *The absorption of the atmosphere for ultra-violet light.* Monthly Weather Review, **42**: 487–489. 1914. (A summary, with references, of all that is known on this subject.—W. J. H.)

MARVIN, C. F. *Are lightning flashes unidirectional or oscillating electric discharges?* Monthly Weather Review, **42**: 499–501. 1914. (Questions the adequacy of recent observations by De Blois to answer this question.—W. J. H.)

MARVIN, C. F. *Air drainage explained.* Monthly Weather Review, **42**: 583–585. 1914. (Explains the phenomenon in a different manner from that of the text-books.—W. J. H.)

MITCHELL, A. J. *Frost and frost protection in Florida.* Monthly Weather Review, **42**: 588–589. 1914.

MÖLLER, MAX. *Mechanics of atmospheric air within cyclones and anticyclones.* Monthly Weather Review, **42**: 265–270. 1914. (A paper communicated to the International Meteorological Congress at Chicago, August, 1893, and therefore, while still good, open to considerable revision and extension. —W. J. H.)

NAKAMURA, K. *Observations of horizontal rainbows.* Monthly Weather Review, **42**: 430–431. 1914. (Reprinted from Jour. Metrl. Soc. Japan, June, 1914.)

OKADA, T. *Notes on the formation of glazed frost.* Monthly Weather Review, **42**: 284–286. 1914. (Reprinted from Jour. Metrl. Soc. Japan, May, 1914. Contains a mathematical discussion of the cooling of rain drops.—W. J. H.)

PALMER, A. H. *Halos and their relation to weather.* Monthly Weather Review, **42**: 446–451. 1914.

REED, C. D. *Drought at New York City.* Monthly Weather Review, **42**: 629–631. 1914. (Tabulates data concerning the principal droughts at New York City during the years 1871–1914.—W. J. H.)

REED, W. G. *Meteorology at the Lick Observatory.* Monthly Weather Review, **42**: 339–345. 1914. (Discusses a continuous record of the meteorological elements of approximately 34 years' length.—W. J. H.)

ROVER, W. H. *A mechanism for illustrating certain systems of lines of force and stream lines.* Bulletin Mount Weather Observatory, **6**: 195–204. 1914.

SANDSTRÖM, J. W. *Influence of terrestrial rotation on the condition of the atmosphere and ocean.* Monthly Weather Review, **42**: 523–526. 1914.

SMITH, G. W. *Forecast distribution.* Monthly Weather Review, **42**: 541–545. 1914.

SMITH, J. WARREN. *Frost warnings and orchard heating in Ohio.* Monthly Weather Review, **42**: 573–583. 1914. (Discusses the practical application of orchard heating in Ohio.—W. J. H.)

SPRAGUE, M. *Frost and frost protection in Texas.* Monthly Weather Review, **42**: 590. 1914.

THIESSEN, A. H. *Protection from frost in Utah.* Monthly Weather Review, **42**: 586–587. 1914.

VOORHEES, J. F. *Notes on frost protection in the vicinity of Knoxville, Tenn.* Monthly Weather Review, **42**: 587. 1914.

WARD, R. DE C. *Land and sea breezes.* Monthly Weather Review, **42**: 274–277. 1914. (Communicated to the International Meteorological Congress at Chicago, August, 1893. A summary of what was then known about these winds, to which not much has since been added.—W. J. H.)

WINSLOW, C. E. A., and BROWNE, W. W. *The microbic content of indoor and outdoor air.* Monthly Weather Review, **42**: 452–453. 1914.

ENTOMOLOGY

BACK, E. A., and PEMBERTON, C. E. *Life history of the melon fly.* Journal of Agricultural Research, **3**: 269–274. December 15, 1914.

CAUDELL, A. N. *Orthoptera of the Yale-Dominican expedition of 1913.* Proceedings of the U. S. National Museum, **47**: 491–495. October 24, 1914. (Lists all of the material collected and describes 2 new species.—J. C. C.)

COAD, B. R. *Feedings habits of the boll weevil on plants other than cotton.* Journal of Agricultural Research, **2**: 235–245. June 15, 1914. (Gives results of experiments of feeding on *Sphaeralcea lindheimeri, Callirrhoe involucrata, C. pedata,* and *Hibiscus syriacus;* also results of experiments showing that it is possible for the boll weevil to breed in the buds of Hibiscus.—J. C. C.)

DAVIDSON, W. M. *Walnut Aphides in California.* Bulletin of the U. S. Department of Agriculture, No. 100. Pp. 1–48, plates 1–4, figs. 1–18. August 31, 1914. (A professional paper containing descriptions of the species, together with the natural enemies and artificial means of control.—J. C. C.)

DAVIS, J. J. *The oat aphis.* Bulletin of the U. S. Department of Agriculture, No. 112. Pp. 1–16, figs. 1–9. August 21, 1914. (Gives a description, together with description of species likely to be mistaken for the oat aphis; give its life history and discusses depradations and remedial measures.—J. C. C.)

DYAR, H. G. *The larvae of some Lepidoptera from Mexico.* Insecutor Inscitiae Menstruus, **2**: 113–117. August, 1914. (Describes the larvae of 9 species.—J. C. C.)

DYAR, H. G. *Utetheisa in Porto Rico.* Insecutor Inscitiae Menstruus, **2**: 129–131. September, 1914. (Describes 2 new varieties.—J. C. C.)

DYAR, H. G. *Descriptions of new species and genera of Lepidoptera from Mexico.* Proceedings of the U. S. National Museum, **47**: 365–409. October 24, 1914. (In this paper the author describes the new genera Nudur in the Lithosiidae; Neomanobia, Calocea, Cacofota, Gorgora, in the Noctuidae; Zaparasa in the Cochlidiidae; Cosmothyris in the Thyrididae; Tippecoa, Cromarcha, Balidarcha, Anemosella, Myolisa, Zaboba, Shacontia, Deuterolia, Euparolia, Mildrixia, Pseudodivona, Cactobrosis, Moodnopsis in the Pyralidae; together with 141 new species and one new subspecies.—J. C. C.)

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 752d meeting was held on February 13, 1915, at the Cosmos Club, President Eichelberger in the chair; 48 persons present. MR. F. B. LITTELL presented a paper on *The Washington-Paris longitude by radio signals*. Transit instruments used were of recent type. The observatory standard Riefler clocks were used and ran so well as to justify interpolation over intervals of several days, thus permitting utilization of all the radio work. The lags of clock signals in passing through relays, which in some cases amounted to one-half second, were measured frequently and resulting corrections were applied. The radio signals from the over-sea station were usually extremely faint and oftentimes unobservable. The errors and personal equations due to the radio work were of the same order of magnitude as those due to the astronomical work. From the work of 39 nights, when radio observations in both directions were secured, the double transmission time, free from the errors of clock corrections, was found to be $0^s.0437 \pm 0^s.0039$. The preferred resulting value for longitude is $5^h\ 17^m\ 36^s.66 \pm 0^s.003$. This agrees well with the adjusted value for 4 cable determinations, viz., $5^h\ 17^m\ 36^s.69$. The paper was discussed by Messrs. PAUL, BOWIE, ABBOT, and PAULING.

Mr. A. J. LOTKA then spoke on *Efficiency as a factor in organic evolution*. Using the rate of increase per head, r, of a given species of organisms as an index of its adaptation to existing conditions, the functional relationship between r and the efficiency of the organism was investigated by analytical methods, making use of the objective standard of values developed by the speaker previously. This efficiency depends on the errors of observation, operation, and mentation of the type-individual, and on the errors of valuation of the representative individual. An expression was obtained for the partial differential coefficient of r with regard to a suitable parameter capable of serving as an index of the imprecision of the organism in a given activity. A separate expression was obtained for the partial differential coefficient of r with regard to errors of valuation. The paper was discussed by Mr. ABBOT with reference to applications to economic questions, and by Mr. BURGESS.

The 753d meeting was held on February 27, 1915, at the Cosmos Club, President EICHELBERGER in the chair; 54 persons present.

Mr. C. G. ABBOT presented a paper entitled, *Experiments in measuring solar radiation from balloons.* The author stated that close agreement had been obtained in spectro-bolometric determinations of the solar constant of radiation at four stations; the mean result of about 700 independent determinations is 1.93 calories per sq. cm. per minute. Although these results depend on estimates of the transmission of the atmosphere, the diversity of the circumstances of the observations is such that the agreement of results strongly indicates their accuracy. It is, however, maintained by some that the work is wholly unsound, and that the real solar constant value is 3.5 calories per sq. cm. per minute or more. Accordingly, a recording pyrheliometer has been devised for use with sounding balloons. It is modified from the silver-disk pyrheliometer now in general use. A blackened disk, lying horizontally, is alternately exposed to the sun and shaded by a conical reflecting shutter at four-minute intervals. A thermometer whose reading is photographically recorded measures the rise and fall of the temperature of the disk. A barometric element records pressure of the atmosphere. Five ascents were made from Avalon, California, in 1913, and three ascents from Omaha in 1914, by coöperation with the United States Weather Bureau. All instruments were recovered. The most successful flight, at noon on July 11, 1914, reached an altitude well above 20,000 meters. Three excellent records of solar radiation were secured near maximum elevation, where the barometric pressure is less than $\frac{1}{20}$ of that at sea-level. These results are in good agreement, and (reduced to mean solar distance) yield a mean value of 1.85 calories per sq. cm. per minute. It is thought that about 2 per cent should be added for the effect of the remaining air, making the value 1.89 for this day. Its probable error is about 3 per cent. The paper was discussed by Mr. WHITE as to the effect of the downward current of air in balloon work; by Mr. WOODWARD, who questioned the usual method of estimation of the quantity of the atmosphere above any level; and by Mr. LAMBERT with reference to the grounds upon which certain investigators base a value of the solar constant at a value near 4 calories.

Mr. R. S. WOODWARD then presented a paper on *The compressibility of the earth's mass,* in which he considered the problem of the radial compressibility of the earth's mass due to change in internal or to surface stress. Assuming this mass to be spherical and that its density is a function only of distance from the center, the variation in length of the radius due to condensation (or dilatation) was shown to be equal to the volume-integral of the condensation divided by the area of the sphere. Application was made of the law of condensation defined by Laplace's hypothesis connecting density and stress in any mass. Using round numbers, this hypothesis leads to the conclusion that if the pressure of the atmosphere were doubled, the radius of the earth would be diminished by two meters. The importance of this conclusion in geology especially was emphasized.

J. A. FLEMING, *Secretary.*

THE GEOLOGICAL SOCIETY OF WASHINGTON

The 291st meeting was held in the lecture room of the Cosmos Club on February 10, 1915.

INFORMAL COMMUNICATIONS

S. R. CAPPS: *An unusual exposure of a great thrust-fault.* A remarkable exposure of a great thrust-fault in the canyon of Nizina River, Alaska, near the mouth of West Fork, was described. A photograph was exhibited, showing a great cliff, about 5,000 feet high, in which the fault is developed in almost diagrammatic perfection. The rocks involved are the Nicolai greenstone (probably Carboniferous), and the Triassic Chitistone limestone and McCarthy shales. A displacement of about one-half mile has taken place; the Chitistone limestone has been reduplicated to almost twice its normal thickness. The crumpling of the overridden beds and the drag of the overriding beds were well brought out.

D. F. HEWETT: *Calculation of the thickness of strata represented in a series of outcrops of varying dip.* A formula was presented for calculating the thickness of folded beds between two horizons of widely diverse inclination. The formula was based upon the assumption of parallel folding, and the degree of accuracy of the various factors involved in the calculation was stated.

Discussion: M. I. GOLDMANN inquired more particularly as to the basis on which the calculations had been made, and this was explained by Hewett. C. E. LESHER mentioned a graphical method which had been proposed for the solution of the problem.

REGULAR PROGRAM

F. C. SCHRADER: *Some features of the ore deposits in the Santa Rita and Patagonia Mountains, Arizona.* The deposits are exposed in about a thousand mines and prospects scattered throughout the mountains. They occur in two sharply contrasted groups that differ considerably in age and represent two distinct periods of mineralization. The earlier and more valuable group occurs in association with the Paleozoic sedimentary rocks and the Mesozoic granular intrusives, and is referred to the late Mesozoic epoch of metallization.

The later group belongs to the great group of metalliferous deposits formed near the surface in the Tertiary volcanic rocks throughout the West by ascending thermal solutions, and in genetic connection with the associated rocks. It is referred to the Miocene and to the late Tertiary epoch of metallization. Its deposits occur chiefly as copper-, silver-, lead-, and gold-bearing fissure veins, in which the filling is mainly quartz, fluorite, and calcite.

The older deposits contain the metals or minerals of gold, silver, copper, lead, zinc, tungsten, and molybdenum. They were apparently deposited at considerable depths, chiefly by ascending thermal solutions that circulated as a close after-effect of the intrusion of Mesozoic

magmas. They comprise three main classes: contact-metamorphic, fissure-vein, and replacement deposits.

The oldest are the contact-metamorphic deposits. Their formation was accompanied by mineralization and the development of the usual garnet zone containing a dozen or more contact-metamorphic minerals. The ferruginous or metallic constituents of these minerals, as andradite, gedrite, and others, were derived chiefly from the magmatic or ensuing solutions of the intrusive rock and not from the host limestone. The deposits are mainly copper-bearing; the chief primary ore minerals are chalcopyrite and cupriferous pyrite. From these two minerals, copper carbonates, oxide, and secondary sulphides, constituting the present workable ore bodies, were formed by oxidation and secondary enrichment.

The fissure veins are numerous and widely distributed. They are about 6 feet in average width. Some are a mile long, and have a known vertical range of nearly a thousand feet. The filling is chiefly quartz, fluorite, and barite. The ore minerals are chiefly argentite, cerargyrite, bromyrite, native silver, gold, pyromorphite, pyrargyrite, various lead, copper, and zinc minerals, molbydenite, wolframite, and scheelite.

The replacement deposits are associated with the contact-metamorphic deposits and some of the vein deposits described above. They occur chiefly in limestone in association with the intrusive rocks. Their principal metallic constituents are lead and silver. To this class apparently belong in large part the deposits at the Mowry mine and at the Total Wreck mine. The Mowry deposits occur on a steeply northward-dipping fault-contact between quartz monzonite on the south and Paleozoic limestone on the north, with altered gabbro underlying the limestone and forming the hanging wall in the deep part of the mine. They are opened to the depth of 500 feet, and for 600 feet longitudinally along the fault, and they extend laterally 100 feet or more back from the fault into the limestone. They consist mainly of lenses or chimney-shaped, nearly vertical bodies, standing or lying parallel with the fault plane, and are composed chiefly of argentiferous ore minerals, cerusite, coarse galena, anglesite, and bindheimite, all contained in a manganiferous and ferruginous gangue consisting principally of psilomelane and massive pyrolusite and hematite. The ore is mostly oxidized to the depth of 300 feet. The deposits are thought to be genetically connected with the gabbro, which seems best able to have supplied the iron and manganese constituents found in the gangue. They were probably deposited in the sulphide form as metasomatic replacements; from the sulphide minerals the present ore minerals and gangue were derived by processes of oxidation. They seem to be similar in character and origin to the Leadville, Colorado, deposits recently described by Philip Argall. (A fuller account is to appear in the forthcoming *U. S. Geol. Survey Bulletin 582*).

Discussion: N. L. BOWEN referred to the analysis of the gabbro as exhibited on the blackboard, and pointed out its remarkable composition, referring to the 7.25 per cent of alkalies and the 1.29 per cent of

MgO. He inquired as to the mineral composition, remarking that with such a large amount of alkalies, alkaline pyroxenes should be expected. SCHRADER had no description of the mineral composition at hand. G. F. LOUGHLIN spoke of the difference between the specimen of quartz monzonite exhibited and the Leadville porphyry. The Arizona specimen appeared more like the quartz monzonites of Utah. He also called attention to the chemical affinities between the analyses of gabbro and quartz monzonite shown, and thought it quite probable that the ores might have been derived from the gabbro.

F. E. MATTHES. *Studies on glacial cirques in the Sierra Nevada.* The better preserved cirques of the central High Sierra, especially those hewn in fairly massive igneous rocks, are found to consist of two distinct and contrasting parts, a lower bowl with smooth, concave slopes, in many instances holding a tarn, and an upper cliff rising from the periphery of the bowl, with rough, hackly face, and nearly vertical profile. The relative proportions of bowl and cliff are by no means the same in all cirques; but the bowl is in every case the dominant feature, constituting the main part of the cirque, while the cliff is distinctly accessory in character, although occasionally assuming considerable height.

The riven, hackly face of the cliff clearly bespeaks frost action. The verticality of its profile and the tendency to overhang, moreover, point to basal sapping; that is, they show that the locus of most intense frost action is situated at the base of the wall. The conspicuous smoothness of contour and the striated and polished surface of the concave bowl-slopes, on the other hand, attest corrasion, principally abrasion—by moving ice. This abraded appearance sets in immediately below the base of the cliff, showing that at that line frost action ceases abruptly and that there is no transition zone in which the two processes blend their effects. The base of the cliff accordingly constitutes a well-defined and conspicuous boundary line, which is interpreted as indicating the depth to which the bergschrund of the ancient glacier opened and to which frost action was permitted to penetrate. (Willard Johnson and Gilbert have referred to it as the "sap line.") If this interpretation is correct, it necessarily follows that the entire cirque bowl—the major part of the cirque—is elaborated through the corrasive action of the ice masses contained in it. Mass corrasion, accordingly, would appear to be the dominant cirque sculpturing process, while bergschrund sapping, as T. C. Chamberlin and R. D. Salisbury have suggested, is merely a peripherally working, auxiliary process. The two processes, while associated, do not necessarily work at the same rate. In many instances cliff sapping appears to have outstripped mass corrasion, because it was aided by the development of joints in the upper parts of the rock mass through weathering at the preglacial surface of erosion. In such cases the cliff stands back from the bowl rim and is separated from it by a narrow shelf. Abrasion by snow shod with rocks fallen from the cliff smooths the shelf and transforms the bowl rim into a rounding curve.

That the ice masses accumulating in a cirque are competent to generate through corrasion alone a bowl characterized by smooth, concave slopes, and hollowed out so as to hold a lake basin, can be demonstrated by analysis of the mechanics involved. Similarly it can be shown that the ice masses flowing out of the cirque are competent by their corrasive action alone to produce a U-shaped trough. Frost sapping, it is true, does take place along the margins of the outflowing glacier, but it does not contribute to the elaboration of the U-trough any more than it contributes to the elaboration of the cirque bowl. It is effective only to the shallow depth to which the marginal crevasses open, and gives rise to special marginal features above the edges of the U-trough; namely, to a shelf or shoulder, and a cliff or scarp. In fact, the marginal shoulder and scarp of the outflow canyon are but the continuations of the shelf and cliff of the cirque, while the U-trough, properly speaking, is the continuation of the cirque bowl. It is not contended that these sculptural features are characteristic of cirques and outflow canyons in all parts of the world. They can acquire prominence only in cirques and canyons carved from prevailing massive rocks, such as those of the Sierra Nevada, for such rocks do not lend themselves well to plucking, and in them mass corrasion must perforce consist mainly of abrasion, which is productive of smoothly curving surfaces, contrasting strongly with the hackly faces of frost-riven cliffs. In densely jointed rocks, on the other hand, mass corrasion may consist of both plucking and abrasion, and the surfaces produced by it are likely to be more or less hackly and therefore not greatly different in appearance from those resulting from frost sapping. In cirques laid in thin-bedded, finely jointed sedimentary rocks, accordingly, one should not expect to find any pronounced contrast in appearance between the bowl slopes and the cliff.

Again, the features of some Sierra cirques are particularly clean-cut because the uniformity of the rock structure makes for uniformity and continuity of the individual sculptural units, and as a consequence the boundary between those units—between bowl and cliff—is sharply defined and regular. Local variations in structure and in resisting qualities, on the other hand, commonly occur in the rocks of most mountain regions. As a consequence, irregularities in cirque sculpture are the rule. Rocks of locally varying structure and resistance, further, are likely to develop ragged surfaces, giving rise to several successive, and more or less discontinuous bergschrunds, and in them clean-cut, simple cirque forms can not be realized. No doubt it is the prevailing irregularity of the cirque forms, due to interfering structures, that has prevented observers in most mountain regions from clearly apprehending the relative importance of the two processes involved in cirque erosion—mass corrasion, and bergschrund sapping. Another circumstance, finally, that appears to have favored the production of a pronounced sap line in the cirques of the High Sierra is indicated by a study of the level reached in the cirques and canyon by the ice of each of the two pleistocene glacial epochs that have occurred in the Sierra

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Nevada. The earlier glaciation was much more extensive than the later one, and the ice levels of the two consequently lie several thousand feet apart in altitude on the middle flanks of the range. As the levels are traced upward, however, they are found to converge until in the immediate vicinity of the Sierra crest they cannot be distinguished from each other. Evidently, then, the ice of the two epochs reached practically the same height in the crestal cirques, and the later glaciers started from substantially the same sap line as did the earlier ones. Furthermore the moraines indicate that the glacierets of recent historic time, many of which were less than one mile long, also started from the sap line left by the Pleistocene glaciers. It is to be inferred, therefore, that at all stages of glaciation the ice filled the crestal cirques to approximately the same depth, and that consequently every glacial episode has reaccentuated the sap line, and has resumed the modeling of the cirques essentially along the lines established by its predecessors.

Discussion: S. R. CAPPS said that it was not entirely evident to him why the sap-line should have had the same level at different glacial epochs. MATTHES replied that he had come to his conclusion on this matter not by analytical reasoning but by following to their convergences the trend of the ice-lines or markings on the rocks made at different epochs. CAPPS favored the idea that the position of the sap-line was due to the height to which snow could accumulate before flow-movement began. MATTHES thought this explanation might well be consistent with his idea.

W. C. ALDEN said that his experience in glacial studies had been chiefly in regions of sedimentary rocks, and spoke of the phenomena in Glacier National Park. In the development of the fine cirques in thin-bedded sedimentaries there shown he believed plucking had been a very great factor. He had not observed MATTHES' sap-line in these cirques. There was good evidence of plucking-effects but not much of abrasion-effects.

R. H. CHAPMAN said that in his opinion the great variety of profiles in cross-sections of cirques in the Glacier Park regions could be ascribed to differences in dip of sedimentary beds.

C. N. FENNER, *Secretary.*

THE BOTANICAL SOCIETY OF WASHINGTON

The 103d regular meeting of the Society was held in the Crystal Dining Room of the New Ebbitt Hotel, at 6.45 p.m., Tuesday, March 2, 1915. Eighty-two members and seventy-eight guests were present, this being the regular annual open meeting for the President's address.

The retiring President, DR. C. L. SHEAR, delivered an address on "*Mycology in relation to Phytopathology.*"

MR. A. S. HITCHCOCK addressed the Society concerning the proposed publication of a local flora, covering the flowering plants and vascular cryptogams of Washington and vicinity, which is being prepared by Washington botanists under the leadership of MR. FREDERICK

V. COVILLE and himself. The flora, as planned, is to include an introduction, a key to the families, keys to the genera of each family, keys to the species of each genus, and statements concerning the habitat, abundance, and local distribution of each species, with suitable references to outside range. Formal descriptions will be omitted, but statements may be given concerning useful or poisonous qualities, economic value, peculiarities of structure, or other points likely to be of interest to the users of a local flora. The area to be covered by the Flora is approximately a circle of 15 miles radius with the capitol as a center, this territory being practically that covered by Ward's Flora of Washington, though it is not intended to exclude from consideration localities that lie a short distance outside of the 15 mile circle. The formal list is to include all indigenous and introduced plants and those that have escaped from cultivation. In addition there will be brief references to the common species of cultivated plants. All the species listed in Ward's Flora or its supplements are to be accounted for, even though they can not now be verified by specimens.

It is proposed to publish in the spring of 1916, if practicable, a preliminary edition of the Flora which shall include the flowering plants and ferns. This will allow one intervening collecting season for collating data and confirming previous records. It is hoped that later editions may be published which shall include the cryptogams.

In 1906 a list of the vascular plants of the District of Columbia and vicinity was compiled by MR. P. L. RICKER, and copies were struck off by mimeograph. This list was based upon Ward's Flora and its supplements. MR. RICKER has prepared and placed on file a card index of additions to the above-mentioned list. At the National Herbarium the District Flora, consisting of all specimens from the area mentioned, has been segregated and can be readily consulted. There is also accessible a detailed outline of the plan of the Flora and a sample illustrating the form to be followed in preparation of manuscripts. Many botanists have been consulted in relation to the project and 29 have signified their willingness to contribute manuscript of particular families or genera.

It is regarded as very desirable also that work should be started this season upon the cryptogams, and it is hoped that as many botanists as possible will coöperate in collecting material or in preparing manuscript for the cryptogams to be included in future editions. All persons interested in the general project of a District Flora are invited to consult with MR. FREDERICK V. COVILLE at the Department of Agriculture or with the speaker at the National Herbarium.

The Society also passed resolutions of regret upon the death of DR. CHARLES E. BESSEY.

PERLEY SPAULDING, *Corresponding Secretary.*

THE SOCIETY OF AMERICAN FORESTERS

MEETINGS

Nine open and six executive meetings of the Society of American Foresters were held during 1914. The following list gives a program of the meetings: first open, then executive:

Open Meetings. January 8: HERMAN H. CHAPMAN, *Methods of studying yields per acre on the basis of age for all-aged stands.* February 5: D. T. MASON, *The management of lodgepole pine.* March 5: FRANKLIN W. REED, *The proper basis for land classification.* April 2: BRISTOW ADAMS, J. H. FOSTER, and F. F. MOON, *New developments in the eastern woodlot problem.* May 7: EARLE H. CLAPP, *The National Forests of Alaska.* October 22: G. A. PEARSON, *Forest planting in Arizona and New Mexico.* November 19: C. J. BLANCHARD, *Reclamation and Forestry.* December 17: KARL W. WOODWARD, *Administration of the National Forests in the Southern Appalachians.*

Executive Meetings. January 22: Annual executive meeting. May 16: Executive meeting to consider report of executive committee. June 17: To adopt resolutions on the death of OVERTON W. PRICE, active member. July 29: To adopt resolutions on the death of LOUIS MARGOLIN, active member. November 7: To adopt resolutions on the death of HENRY GANNETT, associate member. November 20: To consider question of meeting places.

The fifteen meetings of the year represent the largest number held so far in a twelve-month.

The average attendance at open meetings was 50, also the largest average attained, due in part to the open meeting at Cornell in May, attended by 256. The lowest attendance was 8; the average leaving out these two extremes was 27. At the executive committee meetings the average attendance was 16, with the largest at Cornell in May with 31 members present.

Membership. During the year the Society lost, by death, three members, two active and one associate—OVERTON W. PRICE and LOUIS MARGOLIN, and HENRY GANNETT.

A general reorganization of membership in accordance with the revised constitution is in progress, but has not been completed at this date.

During the year 18 active and 8 associate members were added. The present membership is 299, divided as follows: *Active* 240, *Associate* 58, *Honorary* 1, Total 299.

Annual Election. In the annual election closed January 8, 1915, the following candidates were elected: *President,* W. B. GREELEY; *Vice President,* RAPHAEL ZON; *Secretary,* KARL W. WOODWARD; *Treasurer,* LOUIS S. MURPHY; *Executive Committee:* R. S. HOSMER, FILIBERT ROTH, H. O. STABLER, F. A. SILCOX, R. Y. STUART.

KARL W. WOODWARD, *Secretary.*

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 525th regular meeting was held in the Assembly Hall of the Cosmos Club, Saturday, April 4, 1914, with Vice-President Hay in the chair and 35 persons present. The following program was presented:

Notes on the hatching of a local terrapin, Kinosternon pennsylvanicus, WILLIAM PALMER.

An account of a visit to some of the smaller museums, O. P. HAY.

The fishes of the Lahontan Basin, Nevada, J. O. SNYDER.

The 526th regular meeting was held in the Assembly Hall of the Cosmos Club, Saturday, April 18, 1914, with Vice-President Rose in the chair and 40 persons present. The following program was presented:

Notes on Bermuda birds, TITUS ULKE.

Reactions of corals to food and to non-nutrient particles, and the nature of the food of corals, T. WAYLAND VAUGHAN.

The plankton resources of some Massachusetts ponds, A. A. DOOLITTLE.

The 527th regular meeting was held in the Assembly Hall of the Cosmos Club, Saturday, May 2, 1914, with Vice-President Hay in the chair and 46 persons present. The following program was presented:

A journal of the Wilkes Exploring Expedition, W. P. HAY.

The home and country of Linnaeus, S. M. GRONBERGER.

Exhibition of lantern slides of Washington wild flowers, L. D. HALLECK.

W. L. MCATEE, *Acting Recording Secretary.*

The 528th meeting was held in the Assembly Hall of the Cosmos Club, Saturday, October 17, 1914, with President BARTSCH in the chair and 36 persons present. The president announced the death of Theodore N. Gill, a founder and a former president of the Society, and asked the secretary to read the following resolutions which had been adopted by the council:

Whereas, it has pleased Divine Providence to remove our friend, fellow member, and former president, Dr. Theodore N. Gill from the scene of his earthly labors,

Wherefore, be it resolved: That his profound erudition, devotion to research, long continued industry, and voluminous publications on various branches of science justly entitled Dr. Gill to especial distinction as a zoologist, while his kindly nature and generous devotion of his time and thought to the assistance of younger and less experienced students will ever remain a cherished memory among us;

Also, resolved: That to his surviving relatives we tender our sincere sympathy, and the secretary of the Society is requested to communi-

cate to them this expression of our regret for the loss sustained by them and by the scientific world.

WM. H. DALL,
L. O. HOWARD,
L. STEJNEGER,
Committee.

The program was then taken up. Under the heading Brief Notes, Book Reviews, etc., L. O. HOWARD referred to the report that arsenical spraying in connection with the destruction of gipsy moths in New England had destroyed many birds, and stated that investigations had failed entirely to show that any birds were killed. Dr. Peters had suggested to him that the absence of birds in the region of spraying operations was probably due to the fact that the absence of insect food had led them to leave the district. PAUL BARTSCH reported that English sparrows were seen feeding freely on the army worm in the Smithsonian grounds during the recent invasion of that insect.

The regular program consisted of three communications:

A mouse which lived in tree-tops, VERNON BAILEY. The speaker gave an account of the history and habits of *Phenacomys longicauda*, a little known arboreal mouse which inhabits the deep Douglas spruce forests of the Cascade region of the northwest. Personal experiences in hunting the nests of the species and climbing to them were related, and a perfect specimen obtained last summer at Eugene, Oregon, was exhibited. The communication was discussed by W. H. OSGOOD.

Botanical collecting in the Northwest, A. S. HITCHCOCK. The speaker gave a general account of his summer's collecting trip to the northwestern part of the United States and British Columbia. His itinerary included Nebraska, the Black Hills, Glacier Park, Banff, Mt. Baker, Mt. Ranier, and Mt. Hood, in all of which places interesting species of grasses were obtained.

The present state of fox-farming, NED DEARBORN. Last spring the speaker was sent by the Biological Survey to investigate the methods and progress of this industry in Prince Edward Island and elsewhere. He gave a history of fox-farming and its development to the present time, together with personal observations among the fox ranches. The financial inflation of the business and the methods of some of the promoters of fox companies were not commended, but it is his opinion that the industry can be developed into commercial importance. The communication was discussed by T. S. PALMER and by J. WALTER JONES, of Charlottetown, Prince Edward Island.

The 529th meeting was held in the Assembly Hall of the Cosmos Club, Saturday, October 31, 1914, with President BARTSCH in the chair. One hundred and ten persons were present. Five persons were elected to active membership.

The secretary read a letter from Herbert A. Gill acknowledging receipt of resolutions of the Society relating to the death of his brother, Dr. Theodore N. Gill.

Two communications were presented, the first being *Pelage variations of American moles*, by HARTLEY H. T. JACKSON. The speaker classed the variations as generic, geographic, seasonal, senile, and individual, and showed under each class the tendencies of the different genera to show differences in pelage. Under geographic variation he noted that, unlike the eastern moles which are lightest toward the south, *Neurotrichus* is darkest toward the south, and that *Parascalops* darkens southward along the coast, while in the mountains it darkens toward the north. The seasonal variations are especially marked by differences in the location on the body of the animal where the moult begins. *Scalopus* has great seasonal changes and the moult starts on the central line of the body. In *Scapanus* the moult begins at the head and is completed at the posterior. In *Condylura* the moult starts on the flank; in *Neurotrichus* in the head. The remarks were illustrated by specimens which showed the variations under discussion, as well as interesting mutations. In discussing the paper D. E. LANTZ spoke briefly of a possible market for mole fur in the United States.

The second communication was by R. L. GARNER, who related some of his experiences during twenty-five years' study of the great apes of western Africa. He told how he first came to engage in his experiments in investigating the speech of monkeys and how he finally undertook researches in the wilds of the French Congo. His experiences and observations during many years residence at L'Ibesoille and other places, during which he had many opportunities of studying gorillas and chimpanzees at close range, were related. He showed many lantern slides depicting natives and their houses, as well as physical features of the country and the tropical vegetation. Pictures of the large gorilla kept at Breslau for seven years and of "Susie," the chimpanzee trained by Mr. Garner, were also shown. At the conclusion of his remarks he answered many questions from the interested audience.

The 530th regular meeting was held in the Assembly Hall of the Cosmos Club, Saturday, November 14, 1914, with President BARTSCH in the chair and 37 persons present. Three persons were elected to active membership.

Under the heading Brief Notes, etc., M. W. LYON stated that he had recently seen a specimen of the American coot which had been killed on the top of a mountain and inquired whether the occurrence of the species in such localities was common. General T. A. WILCOX remarked that he had seen a similar case. L. O. HOWARD exhibited a canine of the saber-toothed tiger which he recently picked up in the asphalt desposits near Los Angeles, California. A. D. HOPKINS told of cypress wood from the same locality which showed borings of insect larvae. W. H. OSGOOD told of a well preserved tree which he had seen in the same deposit.

The first communication of the regular program was by WILLIAM PALMER, on *Certain Miocene fossils*. The fossils under consideration were obtained in the Miocene cliffs below Chesapeake Beach, Maryland.

Owing to the very scanty material from which Cope and others had described the types in the Museum of the Philadelphia Academy of Natural Sciences it was extremely difficult to identify the material collected by the speaker. He had collected the skulls of three species of porpoises but no vertebrae of the same individuals. As Cope's type specimens of these animals from the Miocene consisted only of a few vertebrae the speaker was not able to determine which name to apply to these skulls. Mr. Palmer exhibited teeth like those which had once been the basis for the false statement that the Hippopotamus was among the early animals of America. Leidy had described similar teeth as those of a porpoise, but the speaker thought they belonged to another animal because of their peculiar structure. The communication was illustrated by many specimens, among which was the skull of a small Zeuglodon. Many of these Miocene fossils are similar to Pliocene types from the cliffs near Antwerp, Belgium, and a comparison of the American and European material is extremely desirable. The communication was discussed by M. W. LYON.

The second communication was by PAUL B. POPENOE who presented an account of *Arabic zoology*. After a short sketch of the rise of Arabic zoology he gave some curious extracts from the writings of Kamal al Din Muhammad ibu Musa al Damiri, whose encyclopedic work, Hayat al Hayawan or the Lives of Animals, finished in 1371, has since been the standard authority among the Moslems. The amusing extracts related to the elephant, the cat, the gorilla, and other species.

The third communication, by WELLS W. COOKE, was an account of the *National Bird Census* taken last July by the Biological Survey in coöperation with the ornithologists of the United States. The objects of the census and methods employed were given, together with results based on the reports that had been obtained. An account of the speaker's personal enumeration of the birds near Viresco, Virginia, and results were exhibited by figures on the blackboard. Several persons took part in the discussion which followed.

The 531st meeting was held in the Assembly Hall of the Cosmos Club, Saturday, November 28, 1915, with President BARTSCH in the chair and 31 persons present. One person was elected to active membership.

Under the heading Brief Notes, etc., C. W. STILES gave a short account of certain results of his efforts at sanitation in relation to intestinal parasites. Messrs. HOWLAND and LYON, took part in the discussion. WM. PALMER exhibited some interesting fossils from the Miocene deposits of the Chesapeake collected by him during the present week.

The regular program consisted of three communications:

A porcupine skull showing an extra pair of upper incisors: M. W. LYON, JR. The specimen under consideration was the skull of a half grown porcupine collected in Borneo by Dr. Abbott which, so far as can

be learned, is unique in character in having two upper incisors instead of one on each side. The speaker considered it a milk incisor that has persisted. He showed lantern slides of the specimen. Messrs. GIDLEY and HOWLAND participated in the discussion, both agreeing with the theory advanced by the speaker.

Notes on some fishes collected by Dr. Mearns in the Colorado River: J. O. SNYDER. The species found in the Colorado basin are distinct from species found elsewhere. The faunas of the river basins of the West show the same feature. From the evidence shown by genera obtained in the different river basins, the speaker concluded that communication must have been at a very remote period. He exhibited specimens collected by Dr. Mearns.

Notes on some birds observed on the Florida Keys in April, 1914: PAUL BARTSCH. The speaker gave an account of observations on birds made during an eight-day cruise among the Florida Keys in April, 1914, and showed by means of lantern slides most of the species in their natural surroundings. Most of the time was spent at Bird Key. Pictures of frigate birds and various species of terns were also used in illustration.

The 35th annual meeting and 532d regular meeting was held in the Assembly Hall of the Cosmos Club, Saturday, December 12, 1914, with President Bartsch in the chair and 18 members present.

The minutes of the 34th annual meeting were read and approved, and the annual reports of the officers and committees were presented.

The election of officers for the year 1915 took place, resulting as follows: *President,* PAUL BARTSCH; *Vice-Presidents,* A. D. HOPKINS, W. P. HAY, J. N. ROSE, MARY J. RATHBUN; *Recording Secretary,* M. W. LYON, JR.; *Corresponding Secretary,* W. L. MCATEE; *Treasuer,* W. W. COOKE; *Members of Council,* HUGH M. SMITH, VERNON BAILEY, WM. PALMER, N. HOLLISTER, J. W. GIDLEY.

President PAUL BARTSCH was selected to represent the Society as Vice-President in the Washington Academy of Sciences.

The President appointed as the Committee on Publication: N. HOLLISTER, W. L. MCATEE, and W. W. COOKE.

D. E. LANTZ, *Recording Secretary.*

ANTHROPOLOGICAL SOCIETY OF WASHINGTON

At the 478th meeting of the Society held December 1, 1914, in the Public Library, Dr. GEORGE S. DUNCAN, of Johns Hopkins University, delivered an address on *The Sumerian people and their inscriptions.* About 140 persons were present. The land between the lower Tigris and Euphrates in very ancient times was inhabited by a non-Semitic people called Sumerians. Their oldest inscriptions antedate 3000 B.C., but the beginning of Sumerian civilization are far older than any inscriptions. The Enlil temple in Nippur dates back probably to 6000 B.C. Semites from Arabia conquered the Sumerians and by 2100 B.C.

ruled over the whole land from Babylon as the capital. Of the Sumerian cities only Lagash and Nippur have been thoroughly excavated. These have yielded most important finds. The Sumerians had a pointed, narrow nose with a straight ridge and narrow nostrils. The cheek bones were high, the mouth small, the lips narrow and finely rounded. The lower jaw was very short, the pointed chin not extending far forward. The eyes were almond shaped. The forehead was rather low, and extended far back from the root of the nose. The face was flat, and the head short. The head and face were shaved. The people were apparently short in stature and thick-set. There is a general agreement that the Sumerians were neither Semites nor Indo-Europeans. A majority of scholars would class them among the Mongolians. Sumerian is an agglutinative language. The only garment worn by the Sumerians was a rough woolen skirt, fastened around the waist by a girdle. Agriculture was a common occupation. Great crops of cereals, such as wheat, barley, millet, and vetches, were grown. The chief fruit tree was the date palm. Many persons were employed as fishers, hunters, weavers, fullers, dyers, brickmakers, potters, smiths, carpenters, boat-builders, goldsmiths, jewelers, sculptors, and carvers in wood and ivory. The learned professions included priests, teachers, librarians, scribes, publishers, notaries, physicians, astronomers, and musicians. The country was divided up into a large number of city states ruled by kings. The oldest Sumerian art is very crude. The highest artistic development was reached about the age of Gudea, circa 2600 B.C. The Sumerians were very religious. The three chief divinities were Anu, god of the sky, Enlil, god of the earth, and Enki, god of the water. The Sumerian religion was a kind of nature worship. The temples consisted of a complex of buildings, the most prominent part of which was the temple tower, a solid strucutre in the shape either of a square or of a parallelogram rising in platforms, one above the other. The temples seem to have had departments for religion, business, administration, law, education, and a library. The priests were the learned men of the time. There were orders of priests and priestesses. The inscriptions of the Sumerians mainly consist of historical records, laws, contracts, epics, and various kinds of religious texts. The oldest records of a paradise, a fall, and a flood are found in Sumerian tablets.

DANIEL FOLKMAR, *Secretary.*

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